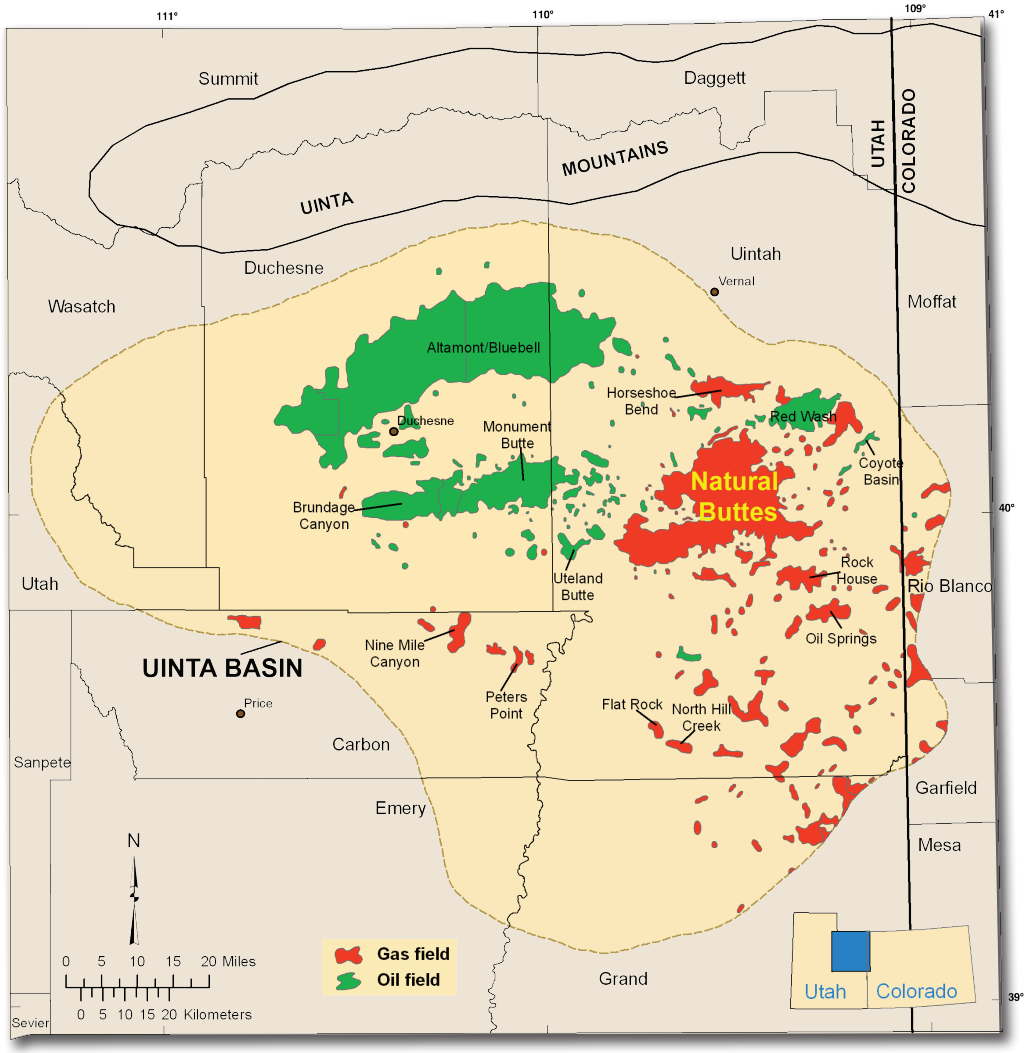
# ENERGY NEWS

## NEW UTAH GEOLOGICAL SURVEY STUDY TO DETERMINE WHAT BEST TO DO WITH WATER PRODUCED FROM GAS FIELDS IN THE UINTA BASIN

*by Thomas C. Chidsey, Jr., and David E. Tabet*

The Utah Geological Survey (UGS) has been funded by the Research Partnership to Secure Energy for America (RPSEA) to conduct a two-year study to characterize the quantity and quality of water produced from tight-gas reservoirs in the Uinta Basin of eastern Utah, and help define best management tools and options to deal with the produced water. Thousands of producing gas wells exist in the eastern part of the basin and hundreds more are planned to be drilled in the years to come (see article by Thomas Chidsey in *Survey Notes*, May 2011, v. 43, no. 2). These wells produce gas stored in small pores within very fine grained (tight) sandstone (the reservoir rock). Future wells may produce gas from shale, a mud- and clay-rich rock having even smaller pores. Improved drilling and well-completion techniques, such as horizontal drilling and hydraulic fracturing (fracking), respectively (see "Energy News" article by Robert Ressetar in *Survey Notes*, May 2012, v. 44, no. 2), have spurred the huge success and surge in drilling activity in the Uinta Basin and elsewhere in the U.S. for these types of gas-bearing rocks. However, large volumes of saline (briny) water are also naturally produced with any hydrocarbons. Typically, this water is disposed of by hauling it from the well site to specially designed evaporation ponds or by injection into deep, porous rock at a sufficient depth as to not cause contamination of shallow freshwater aquifers (porous rock from which water is drawn primarily for household and agricultural use).

With the increased drilling for gas in tight-sandstone and shale reservoirs of the Uinta Basin, the resulting production and disposal of water has recently become a topic of much public debate and concern. In addition, the cost of safely disposing the produced water affects the economics of gas resource development. Thus, there is an economic incentive to minimize the amount of water produced, and/or generate revenue by treating and reusing produced water in hydrocarbon production, particularly in arid regions of the West. Possibilities for reuse include dust abatement, drilling, fracking, and secondary oil recovery (water flooding oil-bearing sandstone reservoirs to increase oil production). Produced water might also be used in future oil shale operations, or other industrial water uses. In addition, some hot water from oil and gas wells has potential for geothermal energy production. The new UGS study will address all these issues.




*Oil and gas fields of the Uinta Basin, eastern Utah.*

The UGS study will comprise the following four major components:

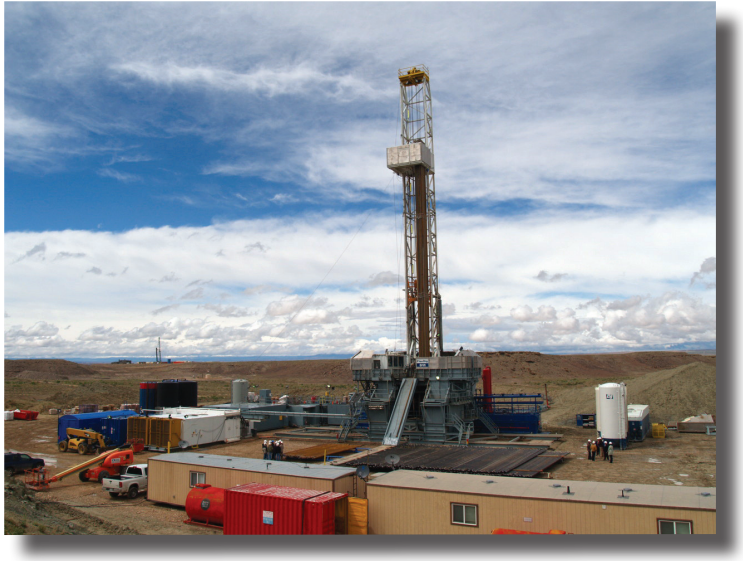
1. Compilation and analysis within a geographic information system (GIS) format of past and new information on (a) the thickness, structure, depth, and rock characteristics of all aquifer/reservoir units in the basin from the surface down through the deep Jurassic-age formations (206 million years old); (b) the regional variations in quality, flow direction, and temperature of water produced from tight-sandstone and shale reservoirs; (c) the location, water satur-

ation volume, and quality of alluvial aquifers (unconsolidated sands and gravels); (d) the existing infrastructure for water management/reuse; (e) the energy generation potential of geothermal produced waters; and (f) the location and geochemical and hydrologic characteristics of aquifers used/proposed for disposal of produced water.

2. Compilation and statistical analysis of water production quantity and quality to identify and forecast produced water production volume trends for each discrete tight-sandstone and shale reservoir to help determine the options for treatment, transportation, disposal, geothermal energy production, and alternative use.

3. Development of alluvial aquifer models to estimate vulnerability to potential contamination from water produced from tight-sandstone and shale development.

4. Evaluation of produced-water management practices and recommendations for improvement.



*Drilling operations in the Uinta Basin. Photo by Michael Vanden Berg.*

This study will involve the staff and expertise of both the UGS groundwater and energy sections. The UGS will also collaborate extensively with sister regulatory agencies within the Utah Department of Natural Resources (Division of Oil, Gas, and Mining, Division of Water Rights, Division of Water Resources) and other agencies such as the Utah Department of Environmental Quality, U.S. Bureau of Land Management, and U.S. Environmental Protection Agency, as well as tribal authorities in the Uinta Basin. Participating industry partners are Anadarko Petroleum, EP Energy, Wind River Resources, EOG Resources, QEP Resources, and XTO Energy. These collaborators will help the UGS identify (1) current produced water management practices, (2) the volume and quality of produced water, and how produced water is disposed, and (3) new recommendations for better ways to economically and safely manage the water produced from increased gas well drilling in the Uinta Basin. Once completed, the results of this study can be applied immediately by all basin producers, regulators, and stakeholders. Finally, by providing sound scientific information, the UGS study will help allay public concerns about the potential for drinking water contamination.

*continued from page 9*

desalinization station that provides warm freshwater showers, and night dives. If you are not a diver or snorkeler you can enjoy fish feeding time or a "mollie pedicure," where schools of tiny fish nibble on your feet and toes. Platforms, ladders, an air-filled underwater conversation area, a shipwreck, and other paraphernalia have been added to the bays. Greenhouse coverings over some of the water surface reduce heat loss in winter.

**Blue Lake** is within a 215-acre Wildlife Management Area comprised of several spring-fed ponds amongst wetlands at the far western edge of the Great Salt Lake Desert, south of Wendover in Tooele County. Blue Lake is the largest natural geothermal pool in the state, with a surface area of 9 acres. The ponds and wetlands host rich fish and bird faunas. A boardwalk lets visitors access the lake during times when a shallow water table makes the lakeshore marshy, and docks and ladders have been constructed for entering and exiting the lake. Blue Lake's floor is strewn with curious objects such as metal animal sculptures and a boat to explore. Late fall and early spring weekdays are the best times of the year to visit; the former has the best clarity of water and fewer bothersome insects. Blue Lake is the only warm-water diving destination in Utah where dogs are permitted—hunters regularly bring their retrievers. The last several miles of the road are unpaved and roughly wash-boarded, but passable for most vehicles in dry weather. The nearest services of any kind are in Wendover, about 25 miles away.


On the western bank of the Malad River in Box Elder County, **Udy Hot Springs** (frequently spelled Uddy) is a cluster of some 50 hot springs and seeps with waters emerging as hot as 125˚F. Some of the springs create a pond and others small pools in the area. These waters were developed into Belmont Springs Park which later became Camperworld Hot Springs Resort. The geothermal pond is open for scuba diving from mid-September or early October to mid-May; in summer the pond becomes too hot for diving. The resort also has a hot spring-fed swimming pool and therapeutic hot tubs, a 9-hole golf course, and 300 acres of open space with walking trails and 70 acres with ATV trails.

**The Crater Mineral Dome** at the Homestead Resort is in Heber Valley north of the town of Midway in Wasatch County. The Midway geothermal area has a number of individual hot springs that form "hot pots," which are roundish, rough-rimmed basins of tufa rock (porous limestone) that has precipitated from the spring water. The Crater is the flagship of the Midway hot pots—a hollow tufa dome measuring some 55 feet high and 300 feet in diameter with a circular opening at the summit that allows sunlight to flood into the void and pool below. In 1996, a 110-foot tunnel was dug into the hot pot wall, permitting horizontal access to the warm pool. Docks, platforms, changing rooms, and lighting have been installed to allow for convenient diving and soaking. Outside the dome, a staircase leads to the summit of The Crater where one can look down into the hot pot through the natural skylight.

Whether you are an experienced diver or just interested in trying it, you don't have to leave the state of Utah for tropical diving. Or if you are a warm spring enthusiast, these springs are well worth a visit.